

# PATENT SPECIFICATION

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## DRAWINGS ATTACHED

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## (54) ELECTRICAL MOUNTING CLIPS

(71) We, ILLINOIS TOOL WORKS INC., a corporation organized under the laws of the State of Delaware, United States of America, of 8501 West Higgins Road, Chicago, Illinois 60631, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to clips for mounting one workpiece with respect to another and simultaneously establishing an electrical connection.

While clips incorporating the features of the present invention may be adapted for a variety of installations, they are especially suitable for mounting and grounding an electrical component such as a printed circuit board with respect to a metal portion of a chassis.

It is an important object of the present invention to provide a novel mounting and grounding clip made from sheet metal and able to be quickly and easily assembled with workpieces such as a printed circuit board and a chassis.

According to this invention, a sheet metal clip for connecting a first workpiece to a second workpiece comprises head means adapted to be mechanically connected to the first workpiece, leg means comprising a pair of leg sections extending in opposed spaced apart relationship from integral junctions with generally opposite margins of the head means, for insertion through an opening in the second workpiece, the leg sections having laterally extending wings, on which are shoulder surfaces for engaging beneath the second workpiece, when the clip is used with the head means uppermost, for securing the clip with respect to the second workpiece, projections carried by the leg means or the head means or

both, disposed for making electrical contact with the second workpiece, and additional projections extending from the head means generally oppositely from the leg means for making electrical contact with the first workpiece.

Various clips embodying the present invention are shown by way of example in the accompanying drawings, and serve to illustrate further features which are preferred though not essential. In these drawings:—

Figure 1 is a perspective view showing a first clip;

Figure 2 is an enlarged partial section showing an assembly comprising workpieces such as a printed circuit board and a chassis which are secured and electrically connected with each other by means comprising the clip of Figure 1 and a complementary screw;

Figure 3 is a view similar to Figure 2 but shows the components in a partially assembled condition, prior to complete tightening of the screw;

Figure 4 is a perspective view showing a slightly modified form of clip;

Figure 5 is an enlarged section taken along the line 5-5 in Figure 4;

Figure 6 is a view similar to Figure 3 but shows another slightly modified clip;

Figure 7 is a perspective view showing a fourth clip; and

Figure 8 is a partial sectional view showing the clip of Figure 7 assembled with two workpieces.

The mounting and grounding clip incorporating the features of the present invention, shown in Figures 1 to 3, is formed from spring sheet metal, preferably by a stamping process, and is adapted to interconnect a pair of workpieces 22 and 24.

As previously indicated, the clip 20 may be adapted for use in various installations. As an illustration of one such installation,

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the workpiece 22 may be a printed circuit board while the workpiece 24 may be a sheet metal part of an electrical chassis. The printed circuit board comprises a sheet 26 of electrical insulating material having a circuit element 28 of copper or the like thereon. The clip 20 is constructed so as to provide a grounding electrical connection between the circuit element 28 and the chassis 24.

The clip 20 is formed so as to include head means in the form of a central head 30 by which the printed circuit board 22 can be supported. A central aperture 32 is provided in the head 30 and is defined by a helically deformed edge 34 which is adapted to cooperate with the threaded shank 36 of a complementary screw 38 for securing the parts together as will be described below.

In order to ensure the establishment of a proper electrical connection between the clip and the board 22, points are formed on the head 30 and project above the generally planar upper surface thereof for engaging and digging into the circuit element 28 when the screw is tightened for clamping the board 22 to the head 30. In this example, the points are in the form of diagonally upwardly inclined sections 40 at corners of relatively unsupported and resilient portions 39 of the generally rectangular head 30. The diagonally inclined arrangement of the points 40 enables them to dig into the circuit element 28 as shown in Figure 2 and further enables them to provide a spring action when the board is clamped under the pressure of the screw. Thus, the head 30 with its diagonally inclined corners 40 and portions 39 functions in a manner similar to a lock washer for resisting loosening of the screw relative to the board 22.

The clip includes leg means in the form of leg sections 42 and 44 extending from integral junctions 46 and 48 respectively with opposite margins of the head 30. The leg sections extend generally axially with respect to the axis of the screw opening 32, and at the same time converge towards their free ends. The chassis 24 is formed with an opening 50 therein through which the legs are adapted to be inserted when the clip is assembled with the chassis as shown in Figures 2 and 3.

In order to secure the clip with respect to the chassis, chassis-engaging wings 52 and 54 project laterally from opposite longitudinal margins of the leg sections. These wings have notches 56 and 58 therein for receiving the edge of the opening 50. These notches are respectively defined by shoulders 60 and 62 facing away from the head 30 and opposed shoulders 64 and 66. The shoulders 64 and 66 have a lateral dimension less than that of the shoulders 60 and

62. In addition, longitudinal edges 68 and 70 of the wings extend in converging relationship from the shoulders 64 and 66 so as to facilitate entry of the leg sections through the opening 50 and snapping of the shoulders 64 and 66 beneath the chassis 24.

The wings 52 and 54 are formed with projections constituted by points 72 and 74 which define the bottoms of the respective notches 56 and 58. These points are adapted to impinge against and dig into the edge of the chassis opening 50 for ensuring an effective localized electrical contact between the clip and the chassis. After the leg sections of the clip are inserted sufficiently through the chassis opening to permit the shoulders 64 and 66 to engage beneath the edge, the inherent resiliency of the spring metal utilized for the clip causes the leg sections to spring away from each other for urging the points 72 and 74 into engagement with the chassis.

While the spring action of the leg sections may be sufficient for maintaining the clip in assembled relationship with and in electrical contact with the chassis in many installations, the clip is constructed for utilizing the fastener shank 36 more positively precluding accidental disengagement. More specifically, free end portions 76 and 78 of the leg sections converge sharply towards each other for providing cam surfaces 80 and 82 respectively. As shown in Figure 3, the cam surfaces are arranged so that the minimum dimension therebetween is less than the diameter of the screw shank. Furthermore, the length of the screw shank is sufficient so that when the screw is fully assembled as shown in Figure 2, the shank extends between the cam surfaces 80 and 82 and wedges the leg sections 42 and 44 away from each other for positively urging the points 72 and 74 into engagement with the edge of the chassis opening.

Figures 4 and 5 show a slightly modified clip. This clip is similar to the construction described above as indicated by the application of identical reference numerals with the suffix *a* added to corresponding elements. In this embodiment, the corners 40 are replaced by projections in the form of annular extrusions 40a punched from the head 30a. It will be noted that the extrusions 40a are located in portions 39a of the head which project laterally outwardly of opposite edges of the leg sections, as are the points 40 of the previously described example. These portions of the head are relatively unsupported by the leg sections so as to provide a portion of the spring action aiding in locking the screw against unwanted rotation.

Figure 6 shows a clip 20b which is essentially identical to the previously described clip 20 as indicated by the applica-

tion of identical reference numerals with the suffix *b* added to corresponding elements. This clip differs only in that a plurality of relatively small points 72*b* and 74*b* are formed at the bottoms of each of the notches 56*b* and 58*b* for engaging the edge of the opening in the chassis.

Figures 7 and 8 show another clip having elements corresponding to the clips described above as indicated by the application of identical reference numerals with the suffix *c* added to corresponding parts. In this example, the upper shoulders 60 and 62 of the previously described forms have been removed from the wings projecting from the legs, and have been replaced by finger elements 60*c* and 62*c* which are struck from central portions of the legs 42*c* and 44*c*. These finger elements present downwardly facing points 72*c* and 74*c* which are not only adapted to impinge on the chassis for establishing localised electrical connection, but are also disposed in opposing relationship to the shoulders 64*c* and 66*c* on the wings for retaining the clip in assembled relationship with the chassis.

The finger element 60*c* and 62*c* not only include portions projecting downwardly for presenting the points for engagement with the chassis, but they also include laterally extending portions 39*c* from which points 40*c* are struck for impinging against and establishing electrical connection with the printed circuit board 22*c* as shown in Figure 8.

In all the examples shown in the drawings, the mechanical connection of the head means of the clip to the first workpiece (i.e. the printed circuit board) is by means of a screw. Alternatively the head means may be secured to the first workpiece by a rivet, either of metal or plastic, the electrical connection being by localised contact, or the mechanical and electrical connection may be both achieved by a welded or soldered connection of the head means to the first workpiece.

In the examples shown, the small surfaces which make localised electrical contact with the second workpiece (i.e. the chassis) are the extremities of pointed elements, but alternatively the small surfaces may be edges so placed as to impinge on an angle on the second workpiece, for example on the junction of the upper surface and the edge of the opening.

#### WHAT WE CLAIM IS:—

1. A sheet metal clip for connecting a first workpiece to a second workpiece, comprising head means adapted to be mechanically connected to the first workpiece, leg

means comprising a pair of leg sections extending in opposed spaced apart relationship from integral junctions with generally opposite margins of the head means, for insertion through an opening in the second workpiece, the leg sections having laterally extending wings, on which are shoulder surfaces for engaging beneath the second workpiece, when the clip is used with the head means uppermost, for securing the clip with respect to the second workpiece, projections carried by the leg means or the head means or both, disposed for making electrical contact with the second workpiece, and additional projections extending from the head means generally oppositely from the leg means for making electrical contact with the first workpiece.

2. A clip, as defined in claim 1, wherein the elements include additional shoulder surfaces on the leg sections, spaced from and opposing the first-mentioned shoulder surfaces, for engaging above the second workpiece.

3. A clip, as defined in claim 2, wherein the first projections are points on the leg sections between the first and second-mentioned shoulder surfaces, for engaging the edge of the opening in the second workpiece.

4. A clip, as defined in claim 3, which includes a plurality of points on each of the leg sections, between the opposing shoulder surfaces.

5. A clip, as defined in any of claims 1 to 4, wherein the head means includes an aperture therethrough with helical thread means for accommodating a screw having an elongated shank for connecting the first workpiece with the head means, and the leg sections include converging portions engageable by the screw shank for spreading the leg sections for positive engagement with the second workpiece.

6. A clip, as defined in claim 5, wherein the head means includes resilient portions, and the projections on the head means are located on the resilient portions, for resisting rotation between the first workpiece and the screw.

7. A clip, as defined in claim 1, substantially as described with reference to Figures 1 to 3, Figures 4 and 5, Figure 6, or Figures 7 and 8 of the accompanying drawings.

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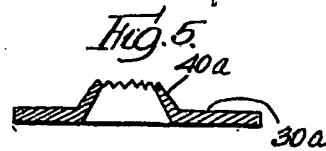
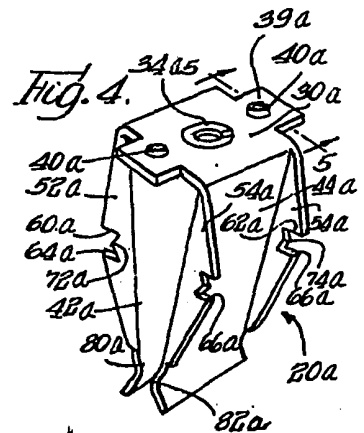
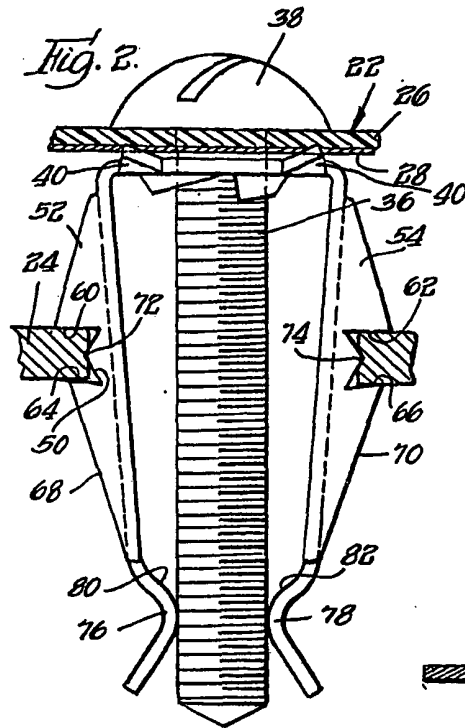
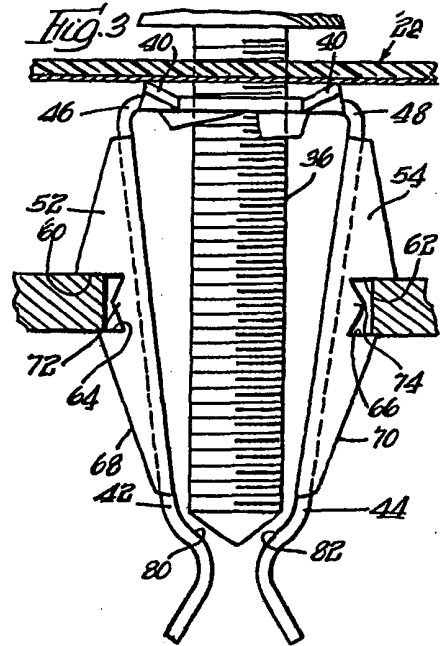
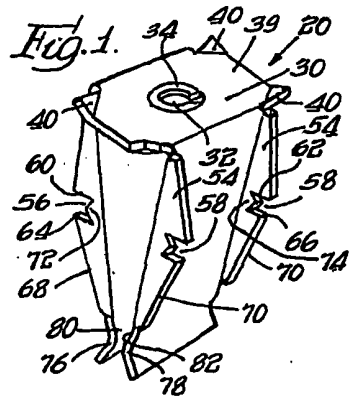
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COMPLETE SPECIFICATION

2. SHEETS

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SHEET 1



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2 SHEETS

COMPLETE SPECIFICATION

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SHEET 2

